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IN RE APPLICATION OF:	Yun Bok LEE, et al.	GAU:	TBA
SERIAL NO:	To Be Assigned	EXAMINER:	TBA
FILED:	February 4, 2000		
FOR:	A Multi-Domain Liquid Crystal Display Device		

REQUEST FOR PRIORITY

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

☐ Full benefit of the filing date of U.S. Application Serial Number [US App No], filed [US App Dt], is claimed pursuant to the provisions of **35 U.S.C. §120**.

☐ Full benefit of the filing date of U.S. Provisional Application Serial Number , filed , is claimed pursuant to the provisions of **35 U.S.C. §119(e)**.

☒ Applicants claim any right to priority from any earlier filed applications to which they may be entitled pursuant to the provisions of **35 U.S.C. §119**, as noted below.

In the matter of the above-identified application for patent, notice is hereby given that the applicants claim as priority:

COUNTRY	APPLICATION NUMBER	MONTH/DAY/YEAR
KOREA	1999-04195	February 8, 1999
KOREA	1999-14492	April 22, 1999

Certified copies of the corresponding Convention Application(s)

☐ are submitted herewith

☒ will be submitted prior to payment of the Final Fee

☐ were filed in prior application Serial No. filed

☐ were submitted to the International Bureau in PCT Application Number .
Receipt of the certified copies by the International Bureau in a timely manner under PCT Rule 17.1(a) has been acknowledged as evidenced by the attached PCT/IB/304.

☐ (A) Application Serial No.(s) were filed in prior application Serial No. filed ; and

(B) Application Serial No.(s)

☐ are submitted herewith

☐ will be submitted prior to payment of the Final Fee

Respectfully Submitted,

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(Translation)

THE KOREAN INDUSTRIAL PROPERTY OFFICE

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Industrial Property Office.

Application Number : Patent Application 14492/1999

Date of Application : April 22, 1999

Applicant : LG. Philips LCD Co., Ltd.

Commissioner

(Translation)

[Document Name] Written Application for Patent
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[Attention] Commissioner of the Korean Industrial Property Office
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[Title of Invention] MULTI-DOMAIN LIQUID CRYSTAL DISPLAY DEVICE
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[Request for Examination] Requested

[Subject of application] Pursuant to Art. 42 of the Patent Law, we apply as above,
Pursuant to Art. 60 of the Patent Law, we submit this request for examination as above.

Patent Attorneys Sang Gu HA
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[Fees]

[Basic pages]	20 pages	29,000 won
[Additional pages]	32 pages	32,000 won
[Priority]	1 set	26,000 won
[Request for Examination]	47 claims	1,613,000 won
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[Affixes]

- A Copy of Abstract and Specification(and Drawings)

[ABSTRACT OF THE DISCLOSURE]

[ABSTRACT]

A multi-domain liquid crystal display (LCD) device is disclosed, which includes first and second substrates facing each other, a conductive layer distorting an electric field on the first substrate; a common auxiliary electrode at the same layer as the conductive layer distorting the electric field; a common electrode on the second substrate; a liquid crystal layer between the first and second substrates; and a storage electrode in an electric field inducing region that divides the liquid crystal layer into at least two domains.

[TYPICAL DRAWINGS]

FIG. 4C

[SPECIFICATION]

[TITLE OF THE INVENTION]

MULTI-DOMAIN LIQUID CRYSTAL DISPLAY DEVICE

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1A and FIG. 1B are cross-sectional views of a related art liquid crystal display device.

FIG. 2A, FIG. 2B, FIG. 2C, FIG. 2D, FIG. 2E, FIG. 2F and FIG. 2G are plan views of a multi-domain LCD device according to the first embodiment of the present invention, and FIG. 2H, FIG. 2I, FIG. 2J and FIG. 2K are cross-sectional views of a multi-domain LCD device according to the first embodiment of the present invention.

FIG. 3A, FIG. 3B, FIG. 3C, FIG. 3D, FIG. 3E, FIG. 3F and FIG. 3G are plan views of a multi-domain LCD device according to the second embodiment of the present invention, and FIG. 3H, FIG. 3I and FIG. 3J are cross-sectional views of a multi-domain LCD device according to the second embodiment of the present invention.

FIG. 4A, FIG. 4B, FIG. 4C, FIG. 4D, FIG. 4E, FIG. 4F and FIG. 4G are plan views of a multi-domain LCD device according to the third embodiment of the present invention, and FIG. 4H, FIG. 4I and FIG. 4J are cross-sectional views of a multi-domain LCD device according to the third embodiment of the present invention.

FIG. 5A to FIG. 5G illustrate various electric field inducing windows or dielectric frames according to the preferred embodiment of the present invention.

Description of reference numerals for main parts in the drawings

1: gate line 3: data line

7: source electrode

9: drain electrode

11: gate electrode

13: pixel electrode

15: common auxiliary electrode

17: common electrode

21: side electrode

23: color filter layer

25: light-shielding layer

27: open area

29: phase difference film

31: first substrate

33: second substrate

35: gate insulating layer

37: passivation layer

39: contact hole

41: storage capacitor

43: first storage electrode

51: electric field inducing window (hole or slit)

53: dielectric frame

63: second storage electrode

65: third storage electrode

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]

The present invention relates to a liquid crystal display (LCD) device, and more particularly, to a multi-domain LCD device forming a common auxiliary electrode surrounding a pixel region, and a storage electrode in the pixel region at the same layer as a gate line and/or a data line, for improving an aperture ratio, and expanding a storage capacitor region.

In recent, an LCD device has been proposed where liquid crystal is not aligned and the liquid crystal is driven by side electrodes insulated from pixel electrodes. FIG. 1A and FIG. 1B are cross-sectional views illustrating a unit pixel region of a related art LCD device. The related art LCD device includes a first substrate, a second substrate

33, a plurality of gate and data lines, a thin film transistor TFT, a pixel electrode 13, a passivation layer 37 and a side electrode 21 (FIG. 1B). At this time, the plurality of gate and data lines are formed on the first substrate for being in perpendicular to each other, thereby defining a plurality of pixel regions. Then, the thin film transistor TFT having a gate electrode, a gate insulating layer, a semiconductor layer, an ohmic contact layer and source/drain electrodes is formed in each pixel region of the first substrate. Also, the pixel electrode 13 is formed on the gate insulating layer, and the passivation layer 37 is formed on an entire surface of the first substrate. Then, the side electrode 21 is formed on the passivation layer 37 for being partially overlapped with the pixel electrode 13. In this state, a structure has been proposed for dividing the pixel region with an open area generated by etching the pixel electrode in a predetermined shape.

Next, a light-shielding layer is formed on the second substrate 33 to shield light leakage from the gate and data lines and the thin film transistor, and a color filter layer is formed on the light-shielding layer. Also, a common electrode 17 is formed on the color filter layer, and a liquid crystal layer is formed between the first and second substrates. At this time, an open area 27 is formed in the common electrode 17, for distorting an electric field applied to the liquid crystal layer.

The side electrode 21 is formed around the pixel electrode 13, and the open area 27 is formed in the common electrode 17. Herein, the side electrode 21 and the open area 27 distort the electric field applied to the liquid crystal layer, thereby driving liquid crystal molecules in a unit pixel region variously. This means that dielectric energy due to the distorted electric field arranges liquid crystal directors in needed or desired positions when a voltage is applied to the LCD device.

However, in the aforementioned LCD device, the open area 27 in the common

electrode 17 or the pixel electrode 13 is necessary for a multi-domain effect. For this, a process for patterning the electrodes is required for manufacturing the LCD device, additionally. In case the open area 27 is not formed, or the open area 27 is narrow, the electric field distortion for domain division becomes weak, so that the time needed to stabilize liquid crystal directors relatively increases.

[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]

Accordingly, the present invention is directed to a multi-domain LCD device that substantially obviates one or more problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide a multi-domain LCD device forming a common auxiliary electrode surrounding a pixel region, and a storage electrode in the pixel region at the same layer as a gate line and/or a data line, for improving an aperture ratio, and expanding a storage capacitor region, to obtain a multi-domain effect.

To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a multi-domain LCD device includes first and second substrates facing each other; a conductive layer distorting an electric field on the first substrate; a common auxiliary electrode at the same layer as the conductive layer distorting the electric field; a common electrode on the second substrate; a liquid crystal layer between the first and second substrates; and a storage electrode in an electric field inducing region that divides the liquid crystal layer into at least two domains.

At this time, a pixel electrode is additionally formed on the conductive layer

distorting the electric field, and the conductive layer distorting the electric field is a gate line at the same layer as the storage electrode.

Also, a supplementary storage electrode is formed on the storage electrode, the gate line and/or the common auxiliary electrode to form a storage capacitor, and the supplementary storage electrode is source and drain electrodes.

Furthermore, the conductive layer distorting the electric field is source and drain electrodes at the same layer as the storage electrode.

In another aspect, a multi-domain LCD device includes first and second substrates facing each other; a pixel electrode on the first substrate; a common auxiliary electrode at the same layer as the pixel electrode; a common electrode on the second substrate; a liquid crystal layer between the first and second substrates; and a storage electrode in an electric field inducing region that divides the liquid crystal layer into at least two domains.

At this time, the pixel electrode is formed on the storage electrode, and the storage electrode serves as a light-shielding layer.

Also, the electric field inducing region is an electric field inducing window or a dielectric frame in the common electrode or the pixel electrode.

[PREFERRED EMBODIMENTS OF THE INVENTION]

Hereinafter, a multi-domain LCD device according to the present invention will be described with reference to the accompanying drawings.

FIG. 2A, FIG. 2B, FIG. 2C, FIG. 2D, FIG. 2E, FIG. 2F and FIG. 2G are plan views of a multi-domain LCD device according to the first embodiment of the present invention, FIG. 2H and FIG. 2I are cross-sectional views taken along line I-I' of FIG.

2A, and FIG. 2J and FIG. 2K are entire cross-sectional views illustrating the preferred embodiment according to FIG. 2H.

As shown in the drawings, the multi-domain LCD device according to the present invention includes a first substrate 31, a second substrate 33, a plurality of gate and data lines 1 and 3, a thin film transistor TFT, a passivation layer 37, a pixel electrode 13 and a common auxiliary electrode 15. At this time, the plurality of gate and data lines 1 and 3 are formed on the first substrate for being in perpendicular to each other, thereby forming a plurality of pixel regions. Then, the thin film transistor including a gate electrode 11, a gate insulating layer 35, a semiconductor layer, an ohmic contact layer and source/drain electrodes 7 and 9 is formed in each pixel region of the first substrate. Also, the passivation layer 37 is formed on an entire surface of the first substrate, and the pixel electrode 13 is formed on the passivation layer for being connected to the drain electrode 9 in one body. Then, the common auxiliary electrode 15 is formed at the same layer as the pixel electrode 13 for surrounding the pixel region, thereby distorting an electric field.

Next, a light-shielding layer 25 is formed on the second substrate 33 to shield light leakage from the gate line 1, the data line 3 and the thin film transistor. Then, a color filter layer 23 is formed on the light-shielding layer 25, and a common electrode 17 is formed on the color filter layer. Subsequently, a liquid crystal layer is formed between the first and second substrates 31 and 33. In this state, the common auxiliary electrode 15 is electrically connected to the common electrode 17, and the pixel electrode 13 is connected to the drain electrode 9 through a contact hole 39.

In the first embodiment of the present invention, a first storage electrode 43 is formed at the same layer as the gate line 11 (FIG. 2I), or at the same layer as the

source/drain electrodes (FIG. 2H), whereby the first storage electrode 43 forms a storage capacitor 41 with the pixel electrode 13. At this time, since the storage electrode 43 is formed as shown in the plan view, portions of disclination in the pixel region of the related art LCD device are covered.

Also, as shown in FIG. 2C, a third storage electrode 65 is additionally formed on the gate line 1 to increase a capacitance of the LCD device, so that an image flicker or a residual image could be removed. In the respective FIG. 2D, FIG. 2E, FIG. 2F and FIG. 2G, the first storage electrode 43 is patterned horizontally, vertically or in a shape of "+" or "X". In these preferred embodiments, a dielectric frame 53 or an electric field inducing window 51 on the second substrate is patterned as above.

FIG. 2J and FIG. 2K are entire cross-sectional views illustrating the preferred embodiment according to FIG. 2H, which illustrate a case forming the dielectric frame 53 on the common electrode 17, and a case forming the electric field inducing window like a hole or a slit 51 in the common electrode 17.

FIG. 3A, FIG. 3B, FIG. 3C, FIG. 3D, FIG. 3E, FIG. 3F and FIG. 3G are plan views of a multi-domain LCD device according to the second embodiment of the present invention, FIG. 3H is a cross-sectional view taken along line II-II' of FIG. 3A, and FIG. 3I and FIG. 3J are entire cross-sectional views illustrating the preferred embodiment according to FIG. 3H.

As shown in the drawings, the multi-domain LCD device according to the second embodiment of the present invention includes a first substrate 31, a second substrate 33, a plurality of gate and data lines 1 and 3, a common auxiliary electrode 15, a first storage electrode 43, a thin film transistor, a passivation layer 37 and a pixel electrode 13. At this time, the plurality of gate and data lines 1 and 3 are formed on

the first substrate for being in perpendicular to each other, thereby forming a plurality of pixel regions. Then, the common auxiliary electrode 15 surrounding the pixel region is formed at the same layer as the gate line, for distorting an electric field. Also, the first storage electrode 43 is formed inside the pixel region at the same layer as the gate line, and the thin film transistor including a gate electrode 11, a gate insulating layer 35, a semiconductor layer, an ohmic contact layer and source/drain electrodes 7 and 9 is formed in each pixel region of the first substrate. The passivation layer 37 is formed on an entire surface of the first substrate, and the pixel electrode 13 is formed on the passivation layer 37 for being connected to the drain electrode 9.

Next, a light-shielding layer 25 is formed on the second substrate to shield light leakage from the gate line 1, the data line 3 and the thin film transistor. Also, a color filter layer 23 is formed on the light-shielding layer 25, and a common electrode 17 is formed on the color filter layer. Subsequently, a liquid crystal layer is formed between the first and second substrates 31 and 33. In this state, the common auxiliary electrode 15 is electrically connected to the common electrode 17. Also, the first storage electrode 43 is connected to the common auxiliary electrode 15, or is formed independently, whereby the first storage electrode 43 forms a storage capacitor with the pixel electrode.

Also, as shown in FIG. 3B, a third storage electrode 65 is additionally formed on the gate line 1 to increase a capacitance of the LCD device, so that an image flicker or a residual image could be removed. In FIG. 3C, all ends of the first storage electrode 43 are connected to the common auxiliary electrode 15, and the third storage electrode 65 is formed on the common auxiliary electrode 15 as well as the gate line 1, which obtains more increased capacitance in comparison with that in the preferred embodiment of FIG.

3B.

In FIG. 3D, FIG. 3E, FIG. 3F and FIG. 3G, the first storage electrode 43 is patterned horizontally, vertically or in a shape of "+" or "X", and in these preferred embodiments, the dielectric frame 53 or the electric field inducing window 51 on the second substrate is patterned as above. FIG. 3I and FIG. 3J illustrate a case forming the dielectric frame 53 on the common electrode 17, and a case forming the electric field inducing window 51 like a hole or a slit in the common electrode 17.

FIG. 4A, FIG. 4B, FIG. 4C, FIG. 4D, FIG. 4E, FIG. 4F and FIG. 4G are plan views of a multi-domain LCD device according to the third embodiment of the present invention, FIG. 4H is a cross-sectional view taken along line III-III' of FIG. 4A, and FIG. 4I and FIG. 4J are entire cross-sectional views illustrating the preferred embodiment according to FIG. 4H.

In the third embodiment, a second storage electrode 63 is additionally formed at the same layer as the data line 3 to the structure according to the second embodiment of the present invention. The second storage electrode 63 is formed in the same shape as the first storage electrode 43 when forming the source/drain electrodes 7 and 9.

In case the second storage electrode 63 is connected to the drain electrode 9, the same voltage with the pixel electrode is applied to the second storage electrode 63, and then the second storage electrode forms a storage capacitor with the first storage electrode connected to the common auxiliary electrode. Meanwhile, if the second storage electrode 63 is formed independently, the second storage electrode 63 forms a storage capacitor with the pixel electrode 13 and the first storage electrode 43.

Also, as shown in FIG. 4B, a third storage electrode 65 is additionally formed on the gate line 1 to increase a capacitance of the LCD device, so that an image flicker or a

residual image could be removed. In FIG. 4C, all ends of the first storage electrode 43 are connected to the common auxiliary electrode 15, and the third storage electrode 65 is formed on the common auxiliary electrode 15 as well as the gate line 1, which obtains more increased capacitance in comparison with that in the preferred embodiment of FIG. 4B.

In FIG. 4D, FIG. 4E, FIG. 4F and FIG. 4G, the first storage electrode 43 is patterned horizontally, vertically or in a shape of "+" or "X", and in these preferred embodiments, the dielectric frame 53 or the electric field inducing window 51 on the second substrate is patterned as above. FIG. 4I and FIG. 4J illustrate a case forming the dielectric frame 53 on the common electrode 17, and a case forming the electric field inducing window 51 like a hole or a slit in the common electrode 17.

To manufacture the multi-domain LCD device having the aforementioned structure, first, a thin film transistor including a gate electrode 11, a gate insulating layer 35, a semiconductor layer, an ohmic contact layer and source/drain electrodes 7 and 9 is formed in each pixel region of a first substrate 31. At this time, a plurality of gate and data lines 1 and 3 are formed on the first substrate 31 for being in perpendicular to each other, to define the plurality of pixel regions.

For forming the gate electrode 11 and the gate line 1, a metal such as Al, Mo, Cr Ta or Al alloy is deposited on the first substrate 31 by sputtering, and a patterning process is performed thereon. Also, a common auxiliary electrode 15 surrounding the pixel region is formed at the same time. After that, a metal such as Indium-Tin-Oxide ITO, Al or Cr is deposited by sputtering, and a patterning process is performed thereto, thereby forming a first storage electrode 43 inside the pixel region.

Next, SiNx or SiOx is deposited by a Plasma Enhancement Chemical Vapor

Deposition PECVD method, and then a patterning process is performed thereto, whereby the gate insulating layer 35 is formed. Subsequently, the semiconductor layer and the ohmic contact layer are formed in a method depositing a-Si and n^+a-Si according to the PECVD method, and patterning the deposited a-Si and n^+a-Si. Then, a metal such as Al, Mo, Cr, Ta or Al alloy is deposited by sputtering, and a patterning process is performed thereto, whereby the data line 3 and the source/drain electrodes 7 and 9 are formed. At this time, an additional storage electrode is formed on the pixel region, the gate line 1 and/or the common auxiliary electrode 15 at the same time.

After that, a passivation layer 37 is formed on an entire surface of the first substrate. At this time, the passivation layer 37 is formed of Benzocyclobuten BCB, acrylic resin, polyimide compound, SiNx or SiOx. Then, a metal such as Indium-Tin-Oxide ITO, Al or Cr is deposited by sputtering, and a pattering process is performed thereto, whereby a pixel electrode 13 is formed. Herein, the pixel electrode 13 may be formed of one metal material by patterning once, or may be formed of different metal materials by patterning twice. Also, the pixel electrode 13 is connected to the drain electrode 9 through a contact hole 39.

Also, the common auxiliary electrode 15 may be formed of the same metal material as the gate line 1 or the pixel electrode 13 by pattering once, or may be formed of different metal materials by patterning twice. When the common auxiliary electrode 15 is formed with the same material as the gate line 1 or the pixel electrode 13, the common auxiliary electrode and the gate electrode are simultaneously formed with one mask, and connected to the common electrode 17 electrically. Also, it is possible to form the common auxiliary electrode 15 and the gate electrode with the different metal materials or a double layer with additional masks.

On a second substrate 33, a light-shielding layer 25 is formed to shield any light leakage from the gate line 1, the data line 3 and the thin film transistor. Also, a color filter layer 23 is formed for alternating R, G and B (Red, Green and Blue) elements on the light-shielding layer 25. Then, a common electrode 17 is formed with ITO on the color filter layer 23, and a liquid crystal layer is injected between the first and second substrates, thereby completing the LCD device.

To apply a voltage (V_{com}) to the common auxiliary electrode 15, Ag-dotting part is formed in each corner of a driving area on the first substrate 31 for being connected to the common auxiliary electrode 15, whereby liquid crystal molecules are driven by a potential difference by applying an electric field to the second substrate 33.

Additionally, a phase difference film 29 is formed on at least one of the first and second substrates 31 and 33 by stretching high molecular substance. At this time, the phase difference film 29 is formed with a negative uniaxial film, which has one optical axis, and compensates the phase difference of the direction according to viewing angle. Herein, it is possible to compensate effectively the right-left viewing angle by widening the area without gray inversion, increasing contrast ratio in an inclined direction, and forming one pixel to multi-domain. In the multi-domain LCD device according to the present invention, it is possible to form a negative biaxial film as the phase difference film, which has two optical axes and wider viewing angle characteristics as compared with the negative uniaxial film.

After forming the phase difference film, polarizers (not shown) are attached to the both substrates. At this time, the polarization axis of the polarizer is at 45° and 135° against the alignment axis of the liquid crystal molecules, and the polarizer may be formed in one body as the phase difference film. Also, an overcoat layer may be

additionally formed on the color filter layer 23. The common electrode 17 is formed by depositing a material such as ITO on the color filter layer 23, and patterning the deposited material.

When forming the multi-domain in the multi-domain LCD device according to the present invention, a storage capacitor is formed between first and second storage electrodes 43 and 63 wherein disclination generates. In comparison with a related art storage electrode overlapped with a gate line, it is possible to expand a storage capacitor region, and to minimize the width of the gate line, thereby enhancing an aperture ratio. That is, the width of the gate line 1 is decreased at 30%, and the aperture ratio is enhanced at 40% to 45%.

FIG. 5A to FIG. 5G illustrate various electric field inducing windows 51 or dielectric frames 53 in the preferred embodiments of the present invention. In the multi-domain LCD device according to the present invention, the dielectric frame 53 is formed in the pixel electrode and/or the common electrode. Or, the electric field inducing window 51 having a hole or a slit therein is formed by patterning the pixel electrode, the passivation layer, the gate insulating layer, the color filter layer and/or the common electrode, thereby obtaining the electric field distortion effect and the multi-domain.

From forming the electric field inducing window 51 or the dielectric frame 53, the multi-domain is obtained by dividing each pixel region into two domains according to a horizontal line, a vertical line or a diagonal line, or by dividing each pixel region into four domains such as a "X", "+", "double Y" or "◇" shape, or by simultaneously patterning "X" and "+" shapes. At this time, the electric field inducing window 51 or the dielectric frame 53 is formed on at least one of the first and second substrates,

independently or together.

In addition, an alignment layer (not shown) is formed on an entire surface of the first and/or second substrates in the multi-domain LCD device according to the present invention. At this time, the alignment layer is formed of polyamide or polyimide group compound, polyvinylalcohol PVA, polyamic acid or SiO_2. When a rubbing process is performed to determine an alignment direction, it is possible to apply any material suitable for the rubbing process.

Also, it is possible to form the alignment layer with a photosensitive material like polyvinylcinnamate PVCN, polysiloxanecinnamate PSCN or Cellulosecinnamate CelCN group compound. Any material suitable for the photo-aligning treatment may be used. By irradiating light to the alignment layer at least once, it is possible to determine the alignment or pretilt direction and the pretilt angle for obtaining alignment stabilization. At this time, the light used in the photo-alignment is preferably is a light in a range of ultraviolet light, and any of unpolarized light, linearly polarized light, and partially polarized light may be used.

In the rubbing or photo-alignment treatment, it is possible to apply one or both of the first and second substrates, and to apply different alignment-treatments on the respective substrates, or to form the alignment layer without the alignment-treatment.

From the alignment-treatment, the multi-domain LCD device is formed with at least two domains, and liquid crystal molecules of the liquid crystal layer are aligned differently one another on each domain. That is, the multi-domain is obtained by dividing each pixel region into four domains such as in the "+" or "X" shape, or dividing each pixel region horizontally, vertically or diagonally, and differently alignment-treating or forming alignment directions on each domain and on each

substrate. It is possible to have at least one domain of the divided domains unaligned. Also, it is possible to have all domains unaligned.

[ADVANTAGES OF THE INVENTION]

As mentioned above, the multi-domain LCD device according to the present invention has the following advantages.

In the multi-domain LCD device according to the present invention, the common auxiliary electrode surrounding the pixel region is formed, and the storage electrode is formed in the pixel region at the same layer as the gate line and/or the data line, thereby maximizing the multi-domain effect with improvement of the aperture ratio and expansion of the storage capacitor region.

Also, in case the common auxiliary electrode is formed at the same layer as the gate line, it is possible to prevent a short between the pixel electrode and the common auxiliary electrode, thereby improving yield.

What is claimed is:

1. A multi-domain LCD device comprising:

first and second substrates facing each other;

a conductive layer distorting an electric field on the first substrate;

a common auxiliary electrode at the same layer as the conductive layer distorting the electric field;

a common electrode on the second substrate;

a liquid crystal layer between the first and second substrates; and

a storage electrode in an electric field inducing region that divides the liquid crystal layer into at least two domains.

2. The multi-domain LCD device of claim 1, further comprising a pixel electrode on the conductive layer distorting the electric field.

3. The multi-domain LCD device of claim 1, wherein the conductive layer distorting the electric field is a gate line.

4. The multi-domain LCD device of claim 3, wherein the gate line is formed at the same layer as the storage electrode.

5. The multi-domain LCD device of claim 4, further comprising a supplementary storage electrode on the storage electrode to form a storage capacitor.

6. The multi-domain LCD device of claim 5, wherein the supplementary storage electrode is source and drain electrodes.

7. The multi-domain LCD device of claim 1, wherein the conductive layer distorting the electric field is source and drain electrodes.

8. The multi-domain LCD device of claim 7, wherein the source and drain electrodes are formed at the same layer as the storage electrode.

9. The multi-domain LCD device of claim 2, wherein the pixel electrode is overlapped with the common auxiliary electrode.

10. The multi-domain LCD device of claim 2, wherein the pixel electrode is not overlapped with the common auxiliary electrode.

11. The multi-domain LCD device of claim 1, wherein the storage electrode serves as a light-shielding layer.

12. The multi-domain LCD device of claim 1, wherein the electric field inducing region is an electric field inducing window in the common electrode.

13. The multi-domain LCD device of claim 1, wherein the electric field inducing region is a dielectric frame in the common electrode.

14. The multi-domain LCD device of claim 2, wherein the electric field inducing region is an electric field inducing window in the pixel region.

15. The multi-domain LCD device of claim 2, wherein the electric field inducing region is a dielectric frame in the pixel region.

16. The multi-domain LCD device of claim 1, wherein the common auxiliary electrode is formed of Indium-Tin-Oxide ITO, Al, Mo, Cr, Ta, Ti or Al alloy.

17. The multi-domain LCD device of claim 2, wherein the pixel electrode is formed of Indium-Tin-Oxide ITO, Al or Cr.

18. The multi-domain LCD device of claim 1, wherein the common electrode is formed of Indium-Tin-Oxide ITO.

19. The multi-domain LCD device of claim 1, wherein an alignment layer is additionally formed on at least one of the first and second substrates.

20. The multi-domain LCD device of claim 19, wherein the alignment layer is divided into at least two portions, liquid crystal molecules of the liquid crystal layer in each portion being aligned differently from each other.

21. The multi-domain LCD device of claim 20, wherein at least one portion of the alignment layer is alignment-treated.

22. The multi-domain LCD device of claim 20, wherein all portions of the alignment layer are not alignment-treated.

23. The multi-domain LCD device of claim 1, wherein the liquid crystal layer include liquid crystal molecules having positive or negative dielectric anisotropy.

24. The multi-domain LCD device of claim 1, wherein liquid crystal layer includes chiral dopants.

25. The multi-domain LCD device of claim 1, further comprising a negative uniaxial film on at least one of the first and second substrates.

26. The multi-domain LCD device of claim 1, further comprising a negative biaxial film on at least one of the first and second substrates.

27. A multi-domain LCD device comprising:

first and second substrates facing each other;

a pixel electrode on the first substrate;

a common auxiliary electrode at the same layer as the pixel electrode;

a common electrode on the second substrate;

a liquid crystal layer between the first and second substrates; and

a storage electrode in an electric field inducing region that divides the liquid crystal layer into at least two domains.

28. The multi-domain LCD device of claim 27, wherein the pixel electrode is formed on the storage electrode.

29. The multi-domain LCD device of claim 27, wherein the storage electrode serves as a light-shielding layer.

30. The multi-domain LCD device of claim 27, wherein the electric filed inducing region is an electric field inducing window in the common electrode.

31. The multi-domain LCD device of claim 27, wherein the electric field inducing region is a dielectric frame on the common electrode.

32. The multi-domain LCD device of claim 27, wherein the electric field inducing region is an electric field inducing window in the pixel region.

33. The multi-domain LCD device of claim 27, wherein the electric field inducing region is a dielectric frame on the pixel region.

34. The multi-domain LCD device of claim 27, wherein the common auxiliary electrode is formed of Indium-Tin-Oxide ITO, Al, Mo, Cr, Ta, Ti or Al alloy.

35. The multi-domain LCD device of claim 27, wherein the pixel electrode is formed of Indium-Tin-Oxide ITO, Al or Cr.

36. The multi-domain LCD device of claim 27, wherein the common electrode is formed of Indium-Tin-Oxide ITO.

37. The multi-domain LCD device of claim 27, wherein an alignment layer is additionally formed on at least one of the first and second substrates.

38. The multi-domain LCD device of claim 37, wherein the alignment layer is divided into at least two portions, liquid crystal molecules of the liquid crystal layer in each portion being aligned differently from each other.

39. The multi-domain LCD device of claim 38, wherein at least one portion of the alignment layer is alignment-treated.

40. The multi-domain LCD device of claim 38, wherein all portions of the alignment layer are not alignment-treated.

41. The multi-domain LCD device of claim 27, wherein the liquid crystal layer include liquid crystal molecules having positive or negative dielectric anisotropy.

42. The multi-domain LCD device of claim 27, wherein the liquid crystal layer includes chiral dopants.

43. The multi-domain LCD device of claim 27, further comprising a negative

uniaxial film on at least one of the first and second substrates.

44. The multi-domain LCD device of claim 27, further comprising a negative biaxial film on at least one of the first and second substrates.

45. The multi-domain LCD device of claim 27, further comprising a supplementary storage electrode at a portion except the pixel electrode.

46. The multi-domain LCD device of claim 4, wherein the storage electrode is electrically connected to the common auxiliary electrode.

47. The multi-domain LCD device of claim 4, wherein a supplementary storage electrode is formed on the gate line and/or the common auxiliary electrode.

FIG. 1A
PRIOR ART

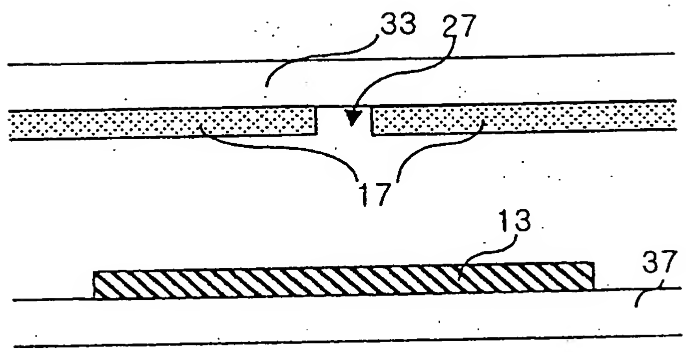

FIG. 1B
PRIOR ART

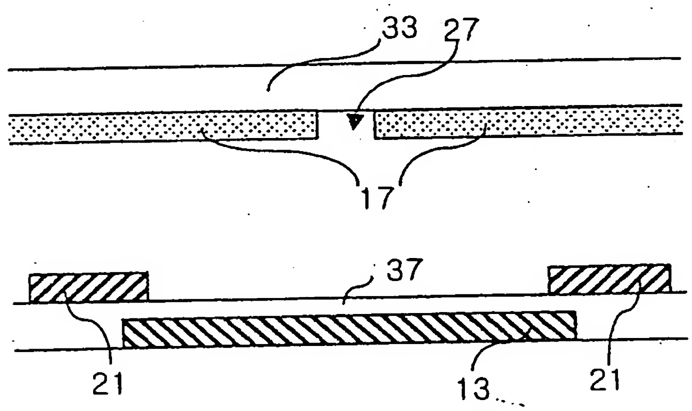

FIG. 2A

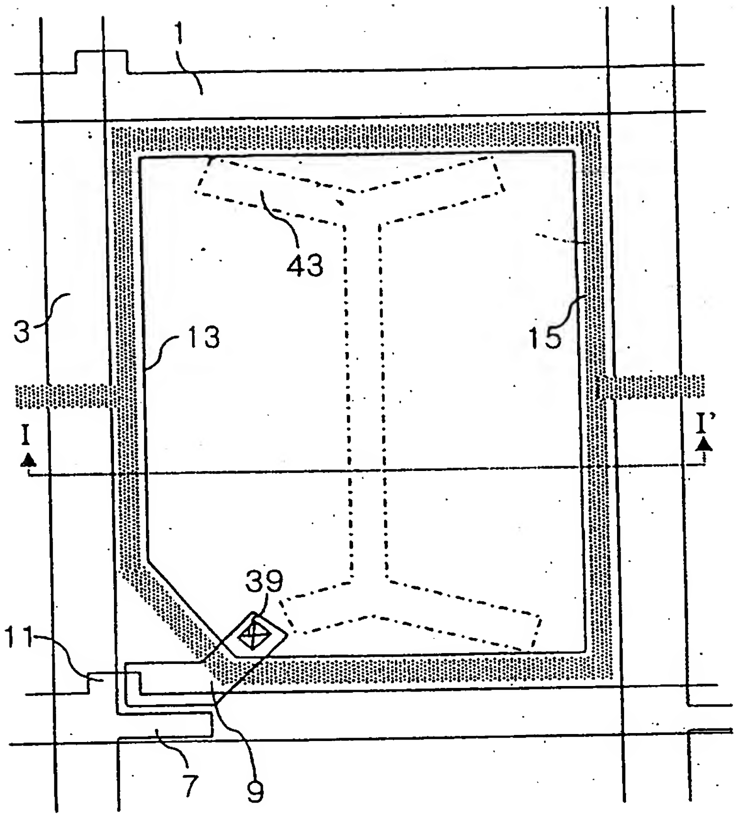

FIG. 2B

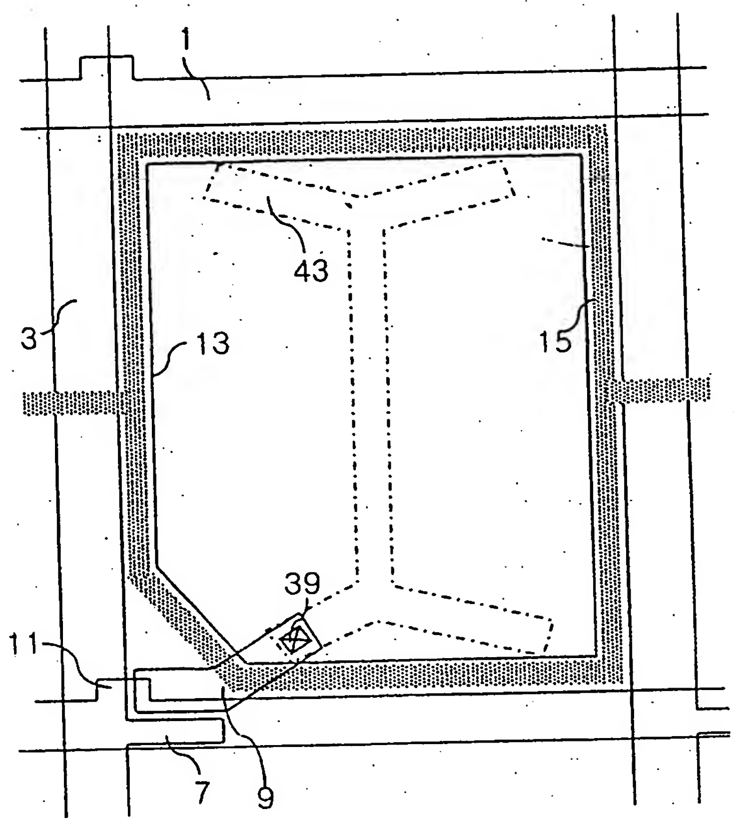

FIG. 2C

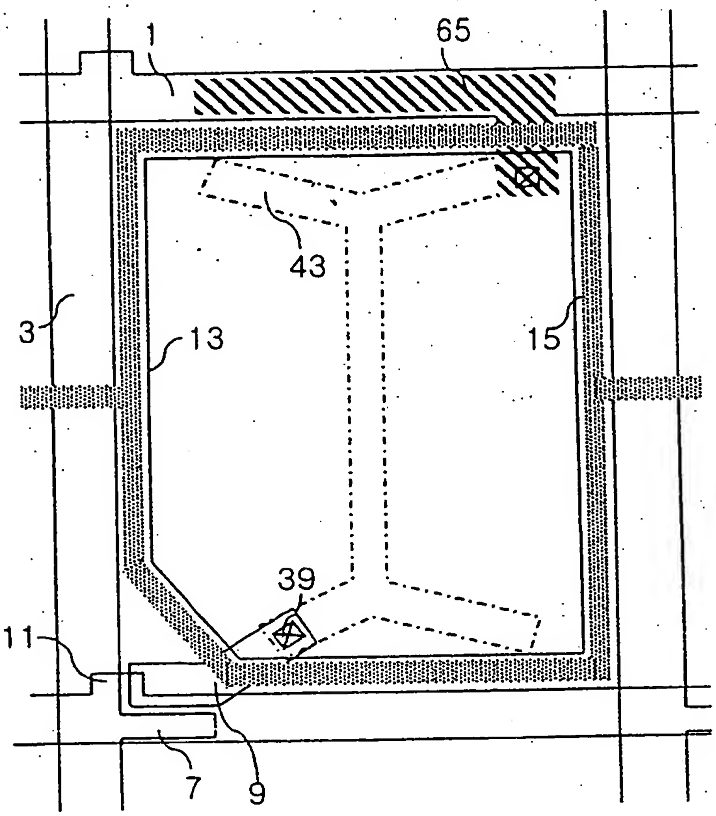

FIG. 2D

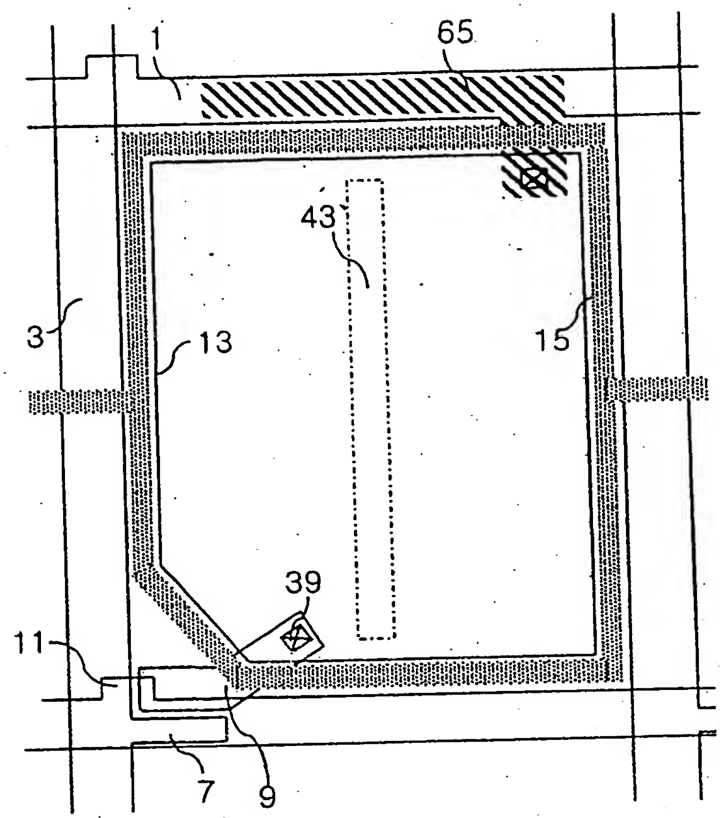

FIG. 2E

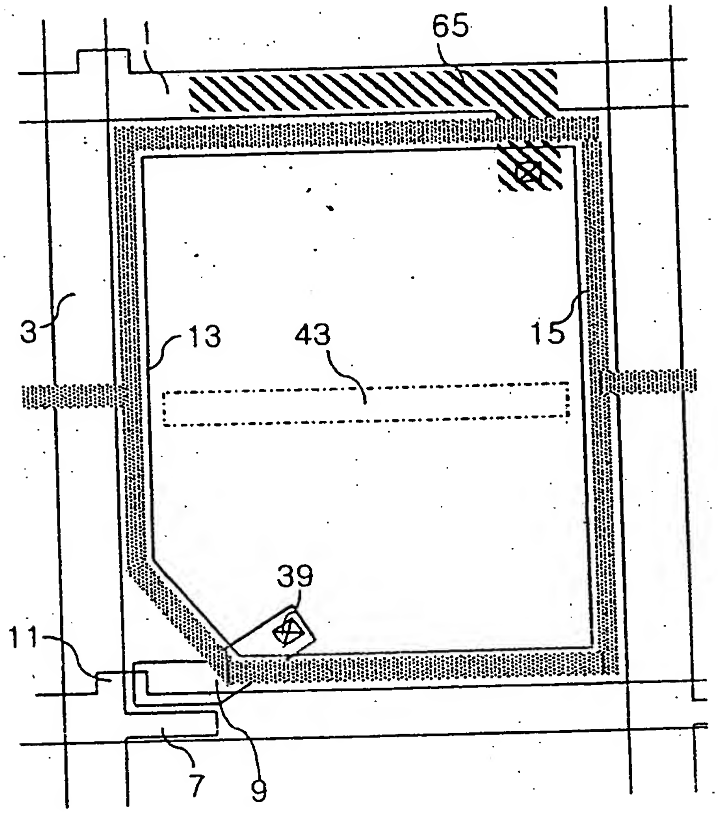

FIG. 2F

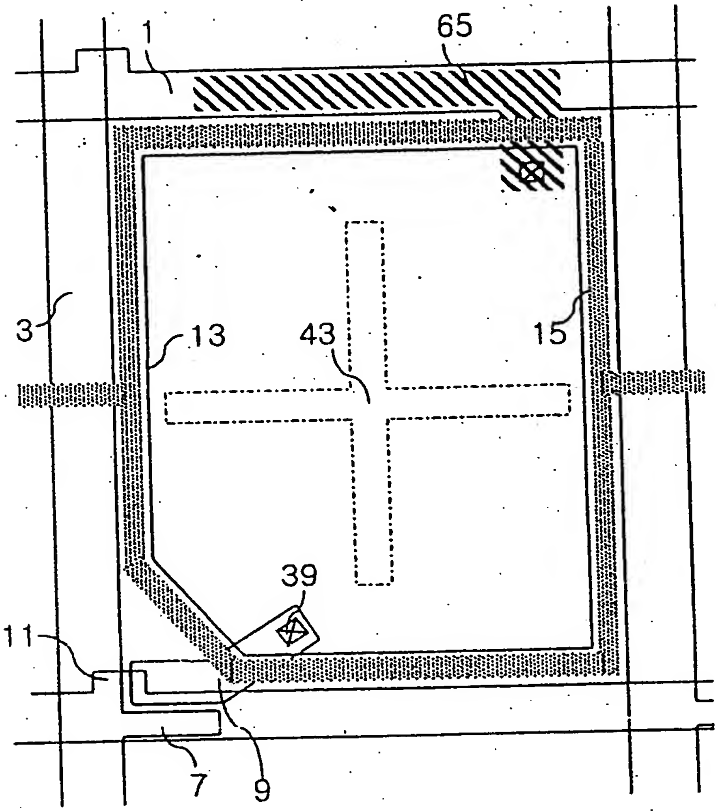

FIG. 2G

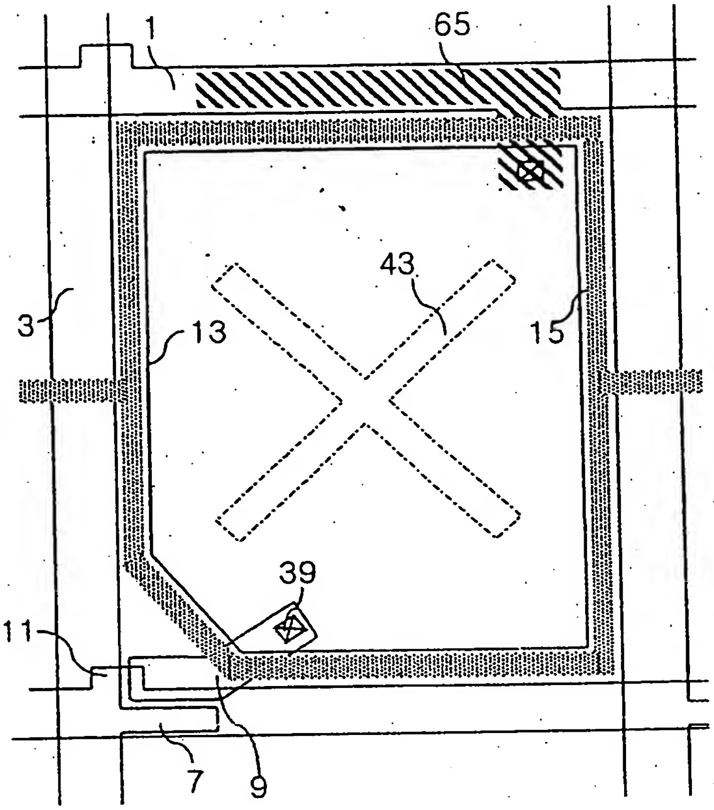

FIG. 2H

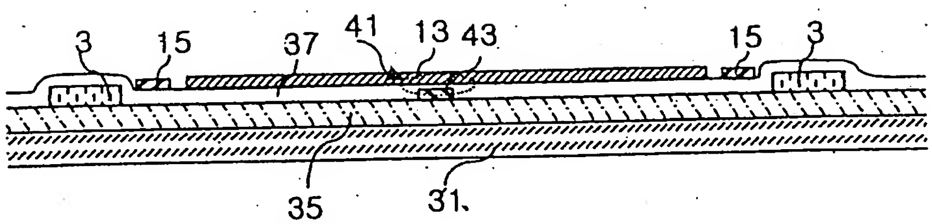

FIG. 2I

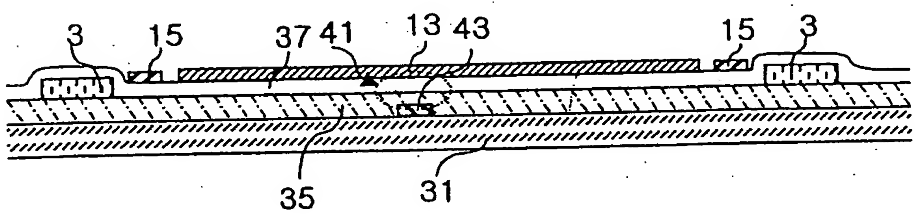

FIG. 2J

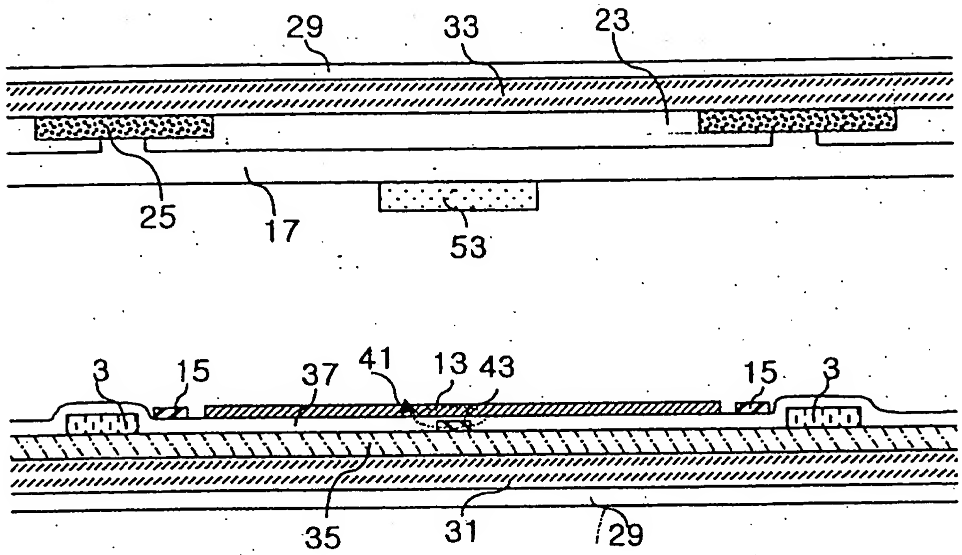
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FIG. 2K

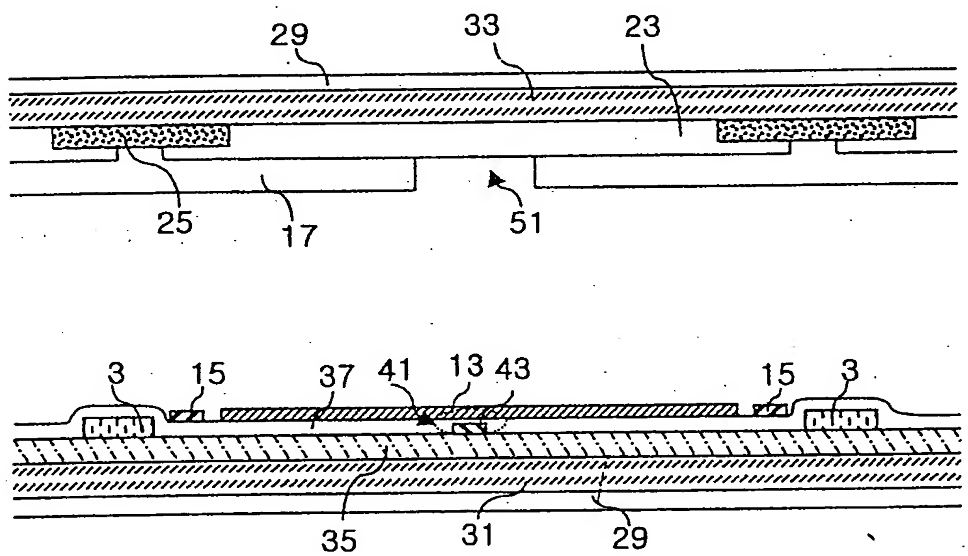
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FIG. 3A

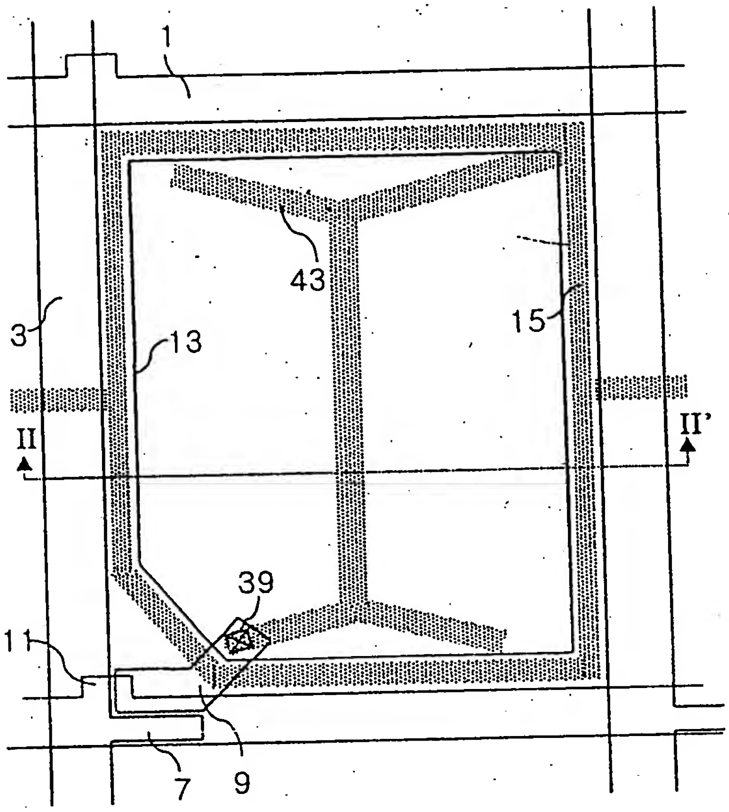

FIG. 3B

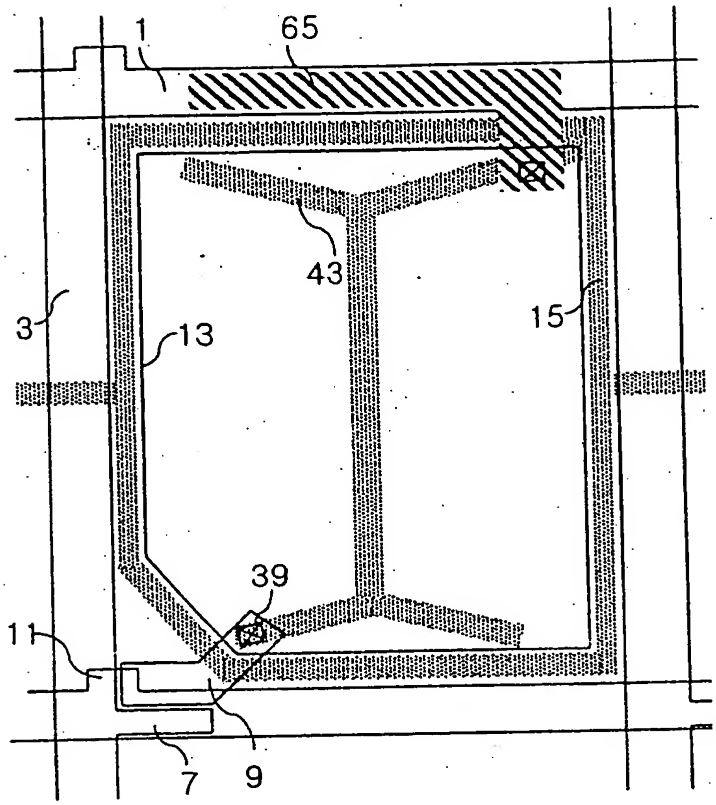

FIG. 3C

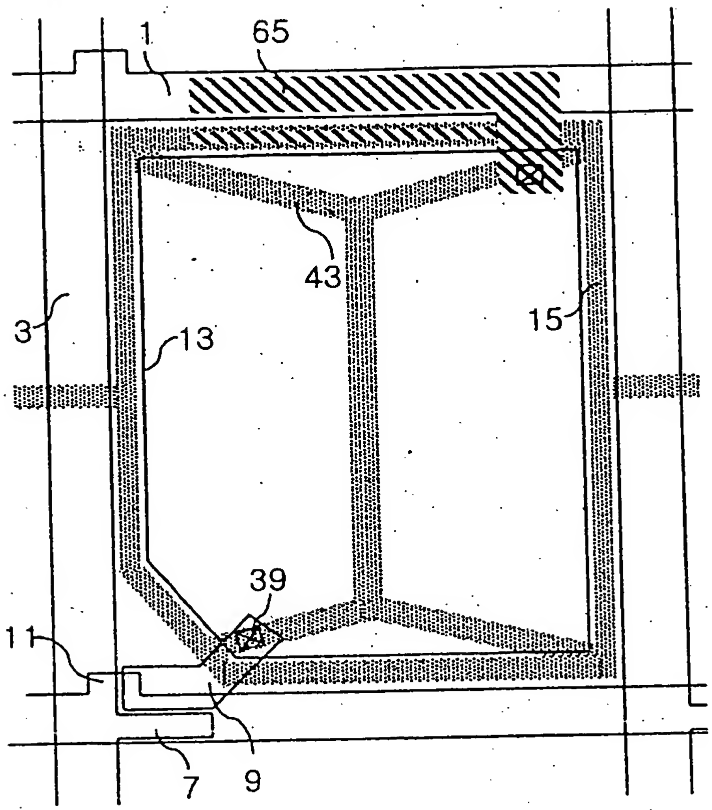

FIG. 3D

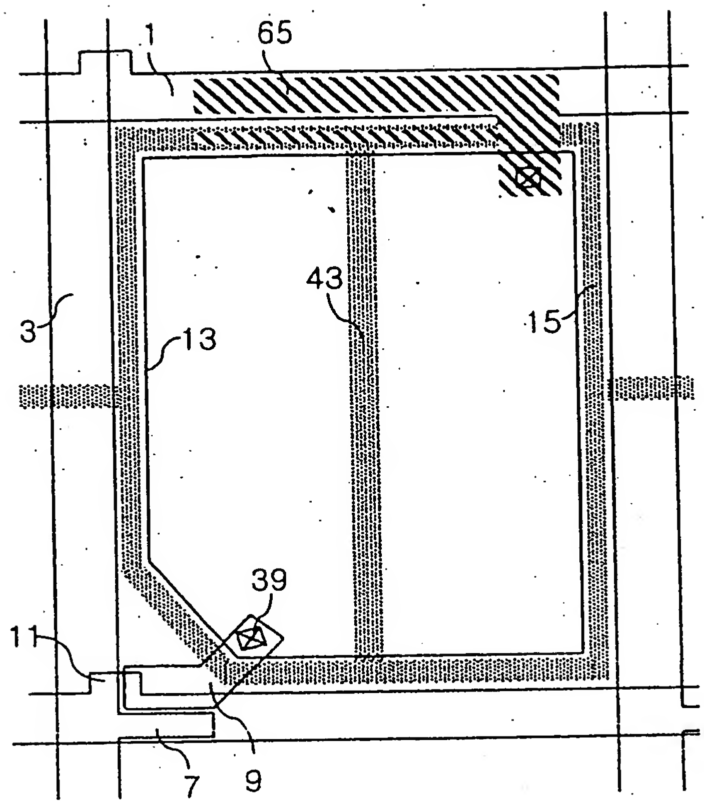

FIG. 3E

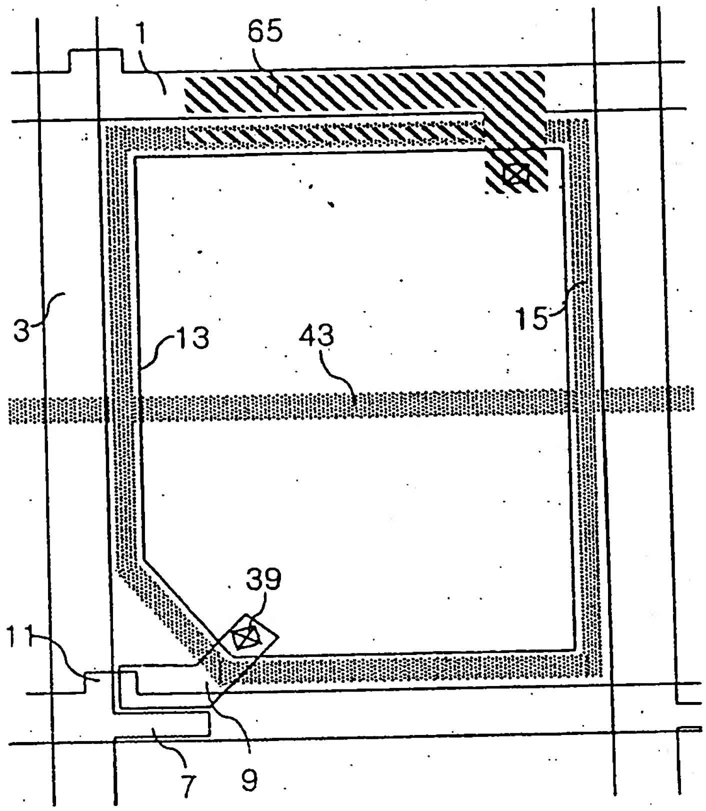

FIG. 3F

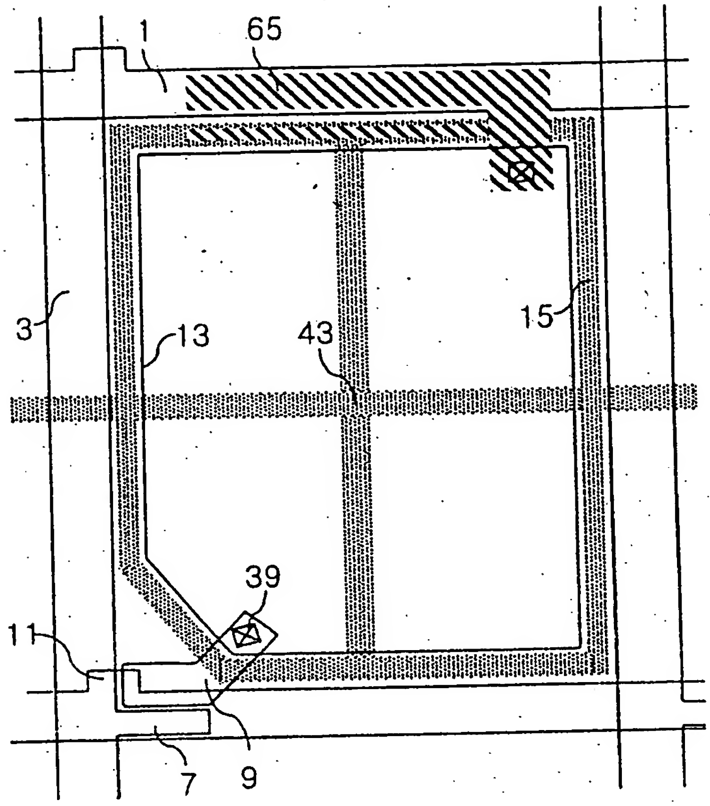

FIG. 3G

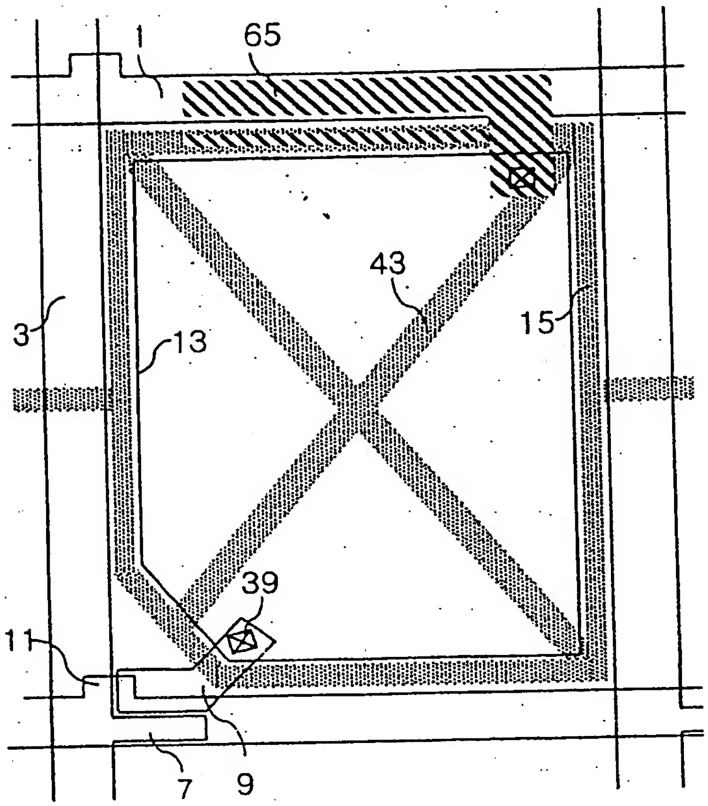

FIG. 3H

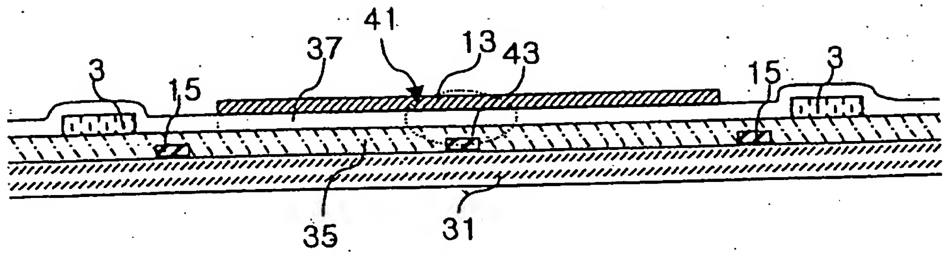

FIG. 3I

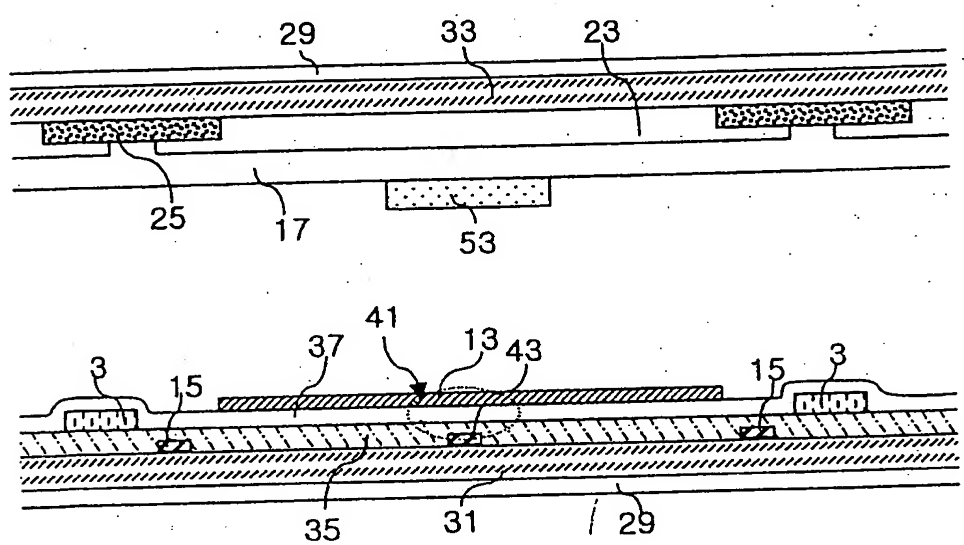

FIG. 3J

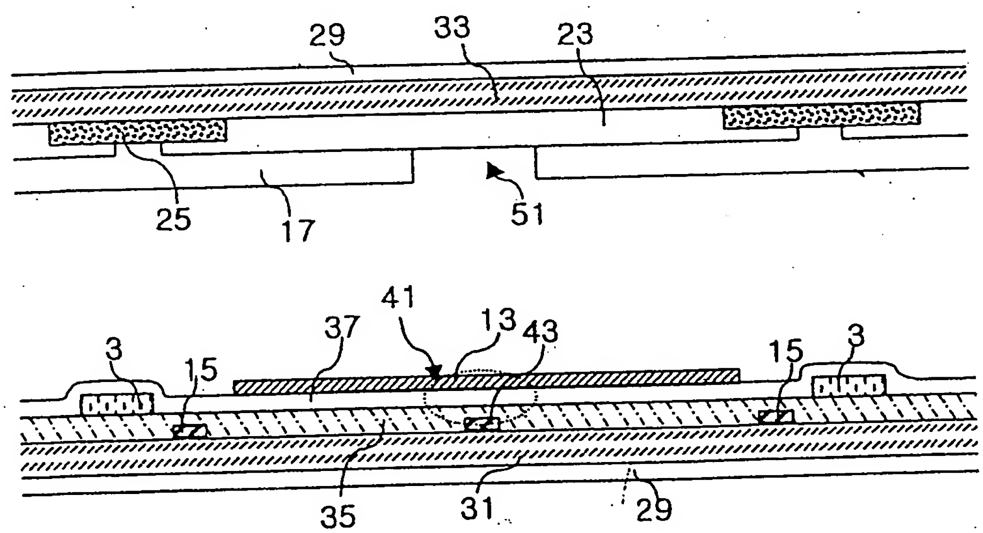

FIG. 4A

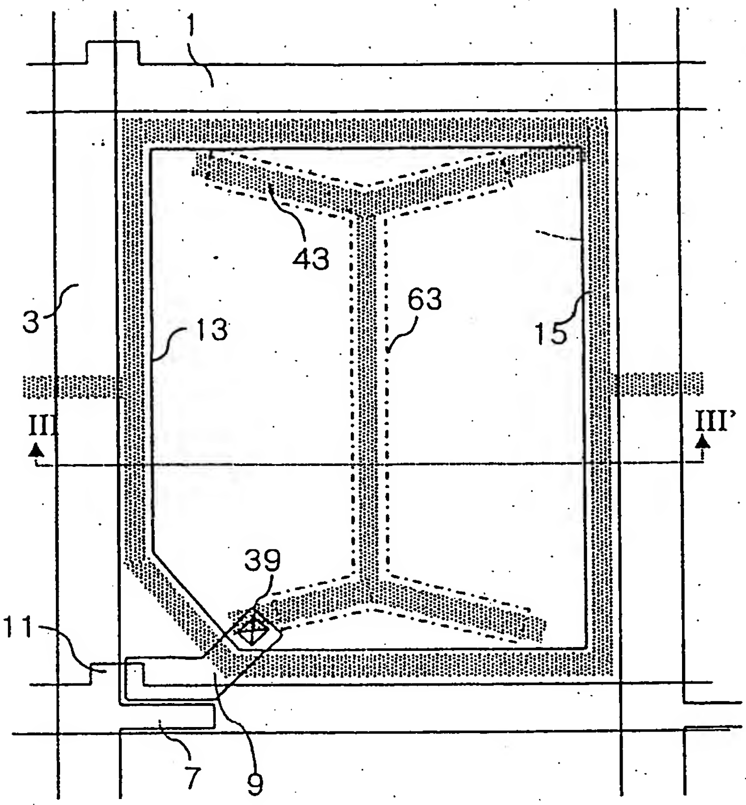

FIG. 4B

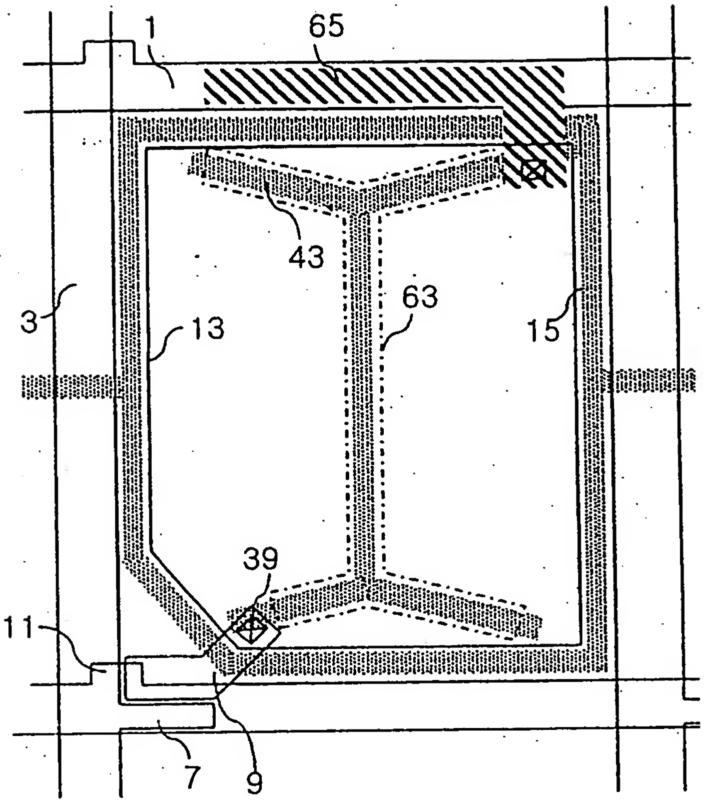

FIG. 4C

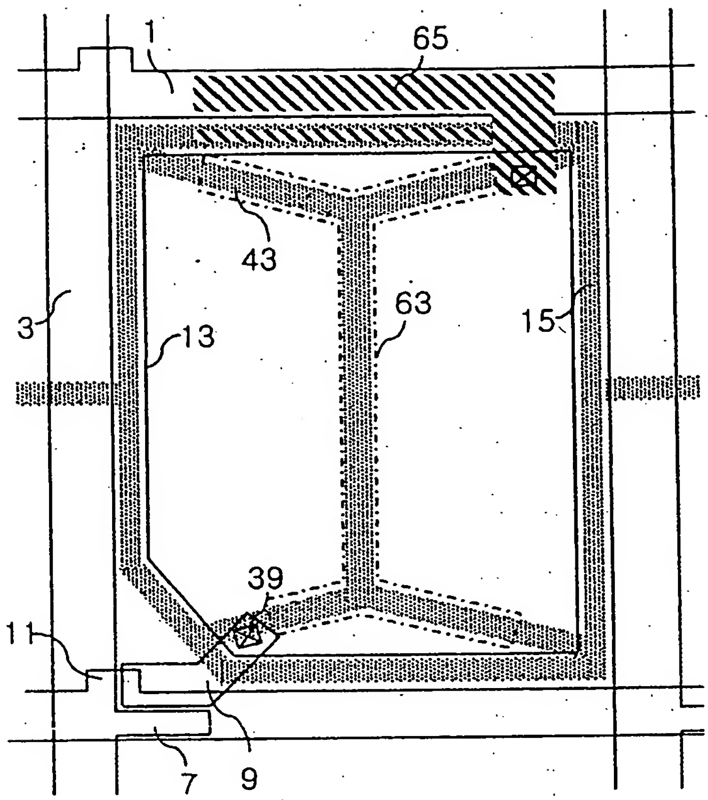

FIG. 4D

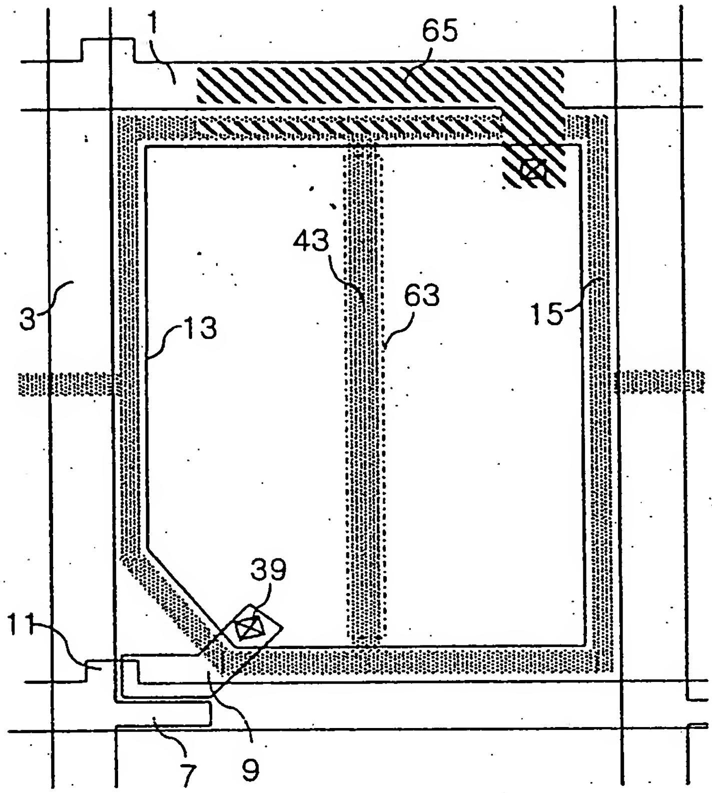

FIG. 4E

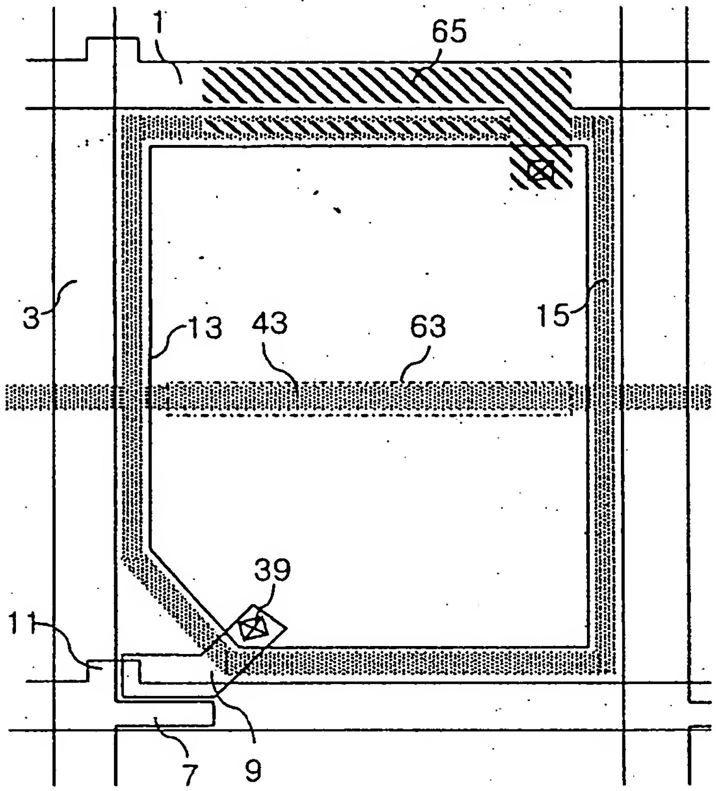

FIG. 4F

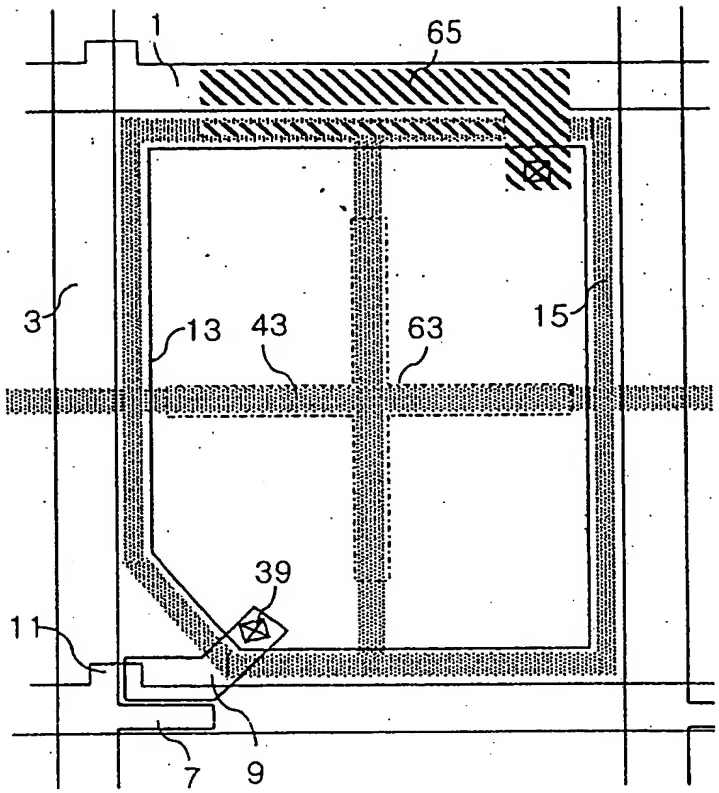

FIG. 4G

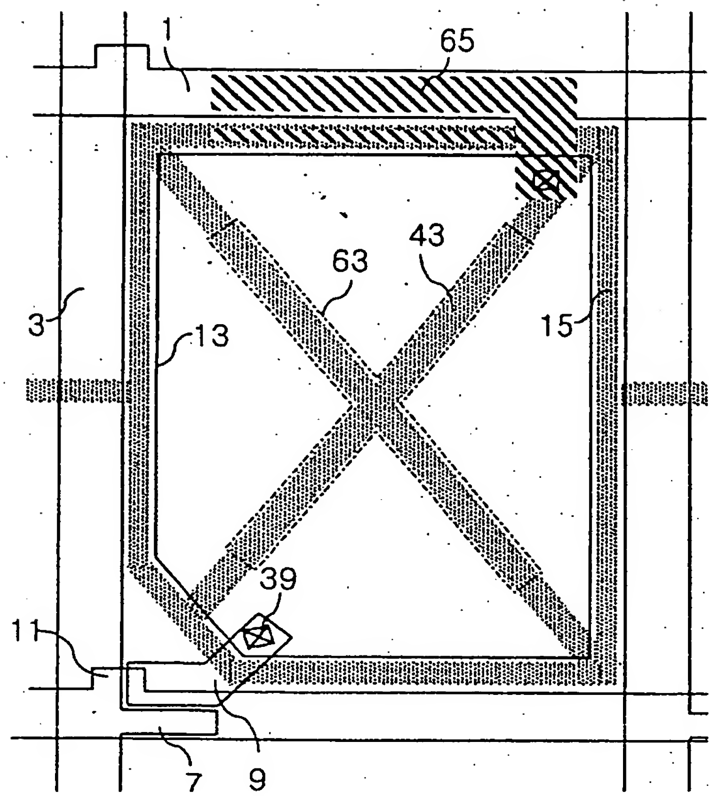

FIG. 4H

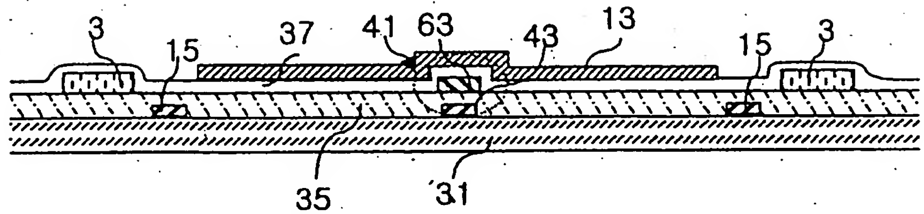

FIG. 4I

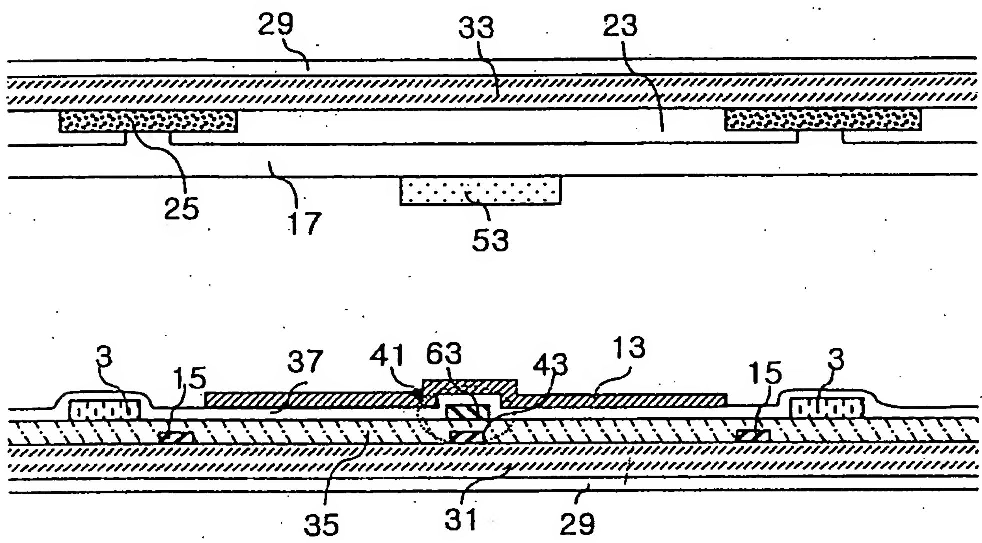

FIG. 4J

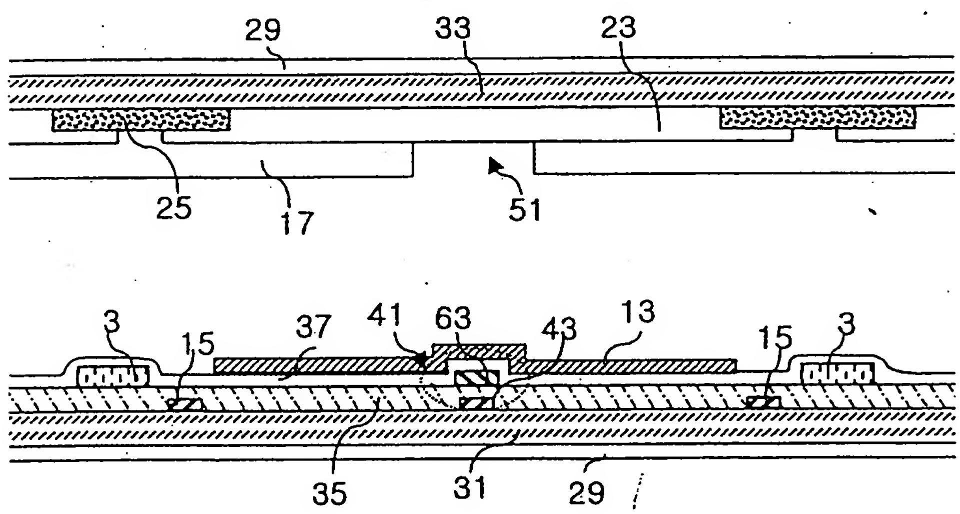

FIG. 5A

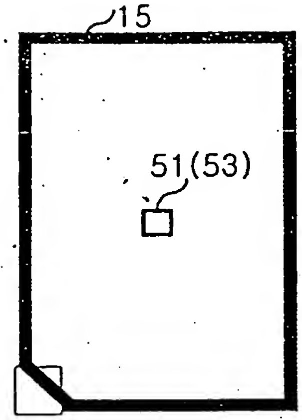

FIG. 5B

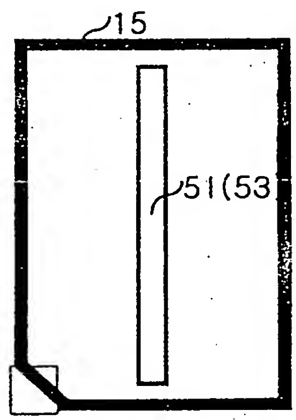

FIG. 5C

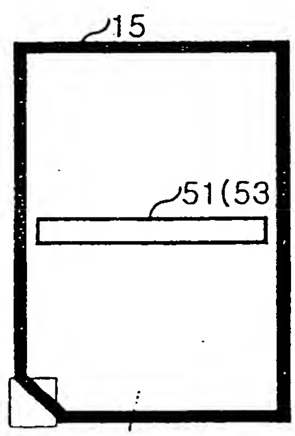

FIG. 5D

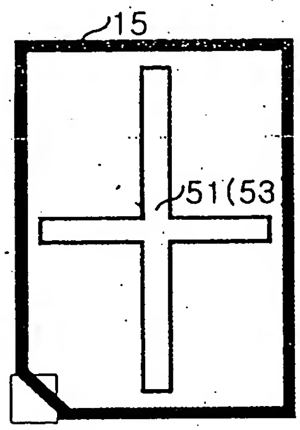

FIG. 5E

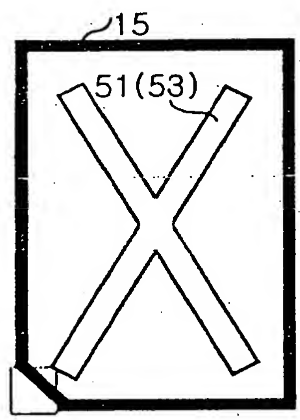

FIG. 5F

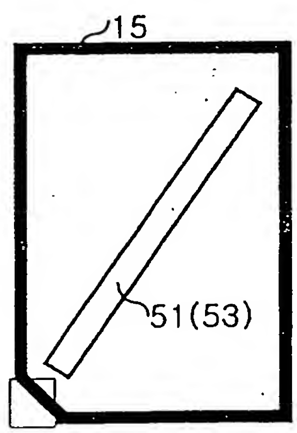

FIG. 5G